

Projectile Murder Mystery

Lesson Plan – For Teacher Use Only

Focus Question

Which suspect is guilty of murder?

Learner Objectives

I can:

- Use the kinematic equations to solve for an unknown variable
- Solve for the velocity of a horizontal projectile given the distances traveled in the x and y directions
- Create a mathematical model to predict for a given scenario
- Work productively in a group

Materials

For each clue (2-6) you should have the following:

- **2-3 printouts for the clue** – enough for everyone to see but not enough for one clue per student
- **Centralized location or table** for students at the clue to discuss

For each group you should have the following:

- Printed Pages
 - **"There's Been a Murder" Introduction** - So that students can refer to the original scenario to compare with their clue information
 - **Clue #1** - so that students can put the larger picture together as a team
 - **Clue Sign Up** - to help students organize and make sure that all clues are covered
 - **Conclusion Sheet** - for groups to make their evidence-based conclusions permanent
- **Centralized location or table** for students to make their clues visible to each other. The following may be used:
 - Dry erase markers and whiteboards
 - Chart paper and markers
 - Neon dry erase markers for students to write on black lab benches

For each student you should have:

- **Evidence Notecard Sheets** - for students to record information about their clues
- **Access to the Kinematic equations** - I just have these posted in my classroom

Classroom Setup

Students should start class sitting in groups of 4-5 at a table or some other centralized location.

Clues will be arranged around the room for the jigsaw portion of the activity. If the room is big enough, these stations can be preset, otherwise, it works fine to assign the group tables with clue numbers before they divide and conquer.

Lesson	
3 min	<p>Setting the Stage</p> <p>Hand out “There’s Been a Murder!” and Clue #1 papers, one of each per group</p> <ul style="list-style-type: none"> • Option 1 <ul style="list-style-type: none"> ○ Read through it together with groups following along • Option 2 <ul style="list-style-type: none"> ○ Give time for the groups to read through it on their own ○ Popcorn share out what you know from this beginning sheet
5 min	<p>Outline the Objective – “Which of our suspects is guilty of murder?”</p> <ol style="list-style-type: none"> 1. <i>“In a moment, you will each go out into the field to collect evidence. There are 5 remaining clues, one for each person in your group. Just like in the real world, be diligent in recording your observations and inferences because you won’t be able to take the clue back with you.”</i> 2. Have students fill out the “Clue Sign Up” for their group so they know who will be heading to each clue station <ol style="list-style-type: none"> a. The following differentiation hints might be useful to point out <ol style="list-style-type: none"> i. Clue 2 requires the strongest understanding of physics ii. Clues 3 & 6 require the strongest understanding of mathematical modeling iii. Clues 4 & 5 require several important details to record 3. Hand out the “Evidence Sheet”, one per person. 4. <i>“You will each have 5 minutes with your clue. Be sure to record any information that you think may be important for your group because you not be allowed to return to the clue. Stay by your clue for the entire time so that all group members have time to fully analyze their clue”</i> 5. Provide an opportunity for class to ask for clarifications about the process
6 min	<p>Clue Time</p> <ol style="list-style-type: none"> 1. Each group member goes to a different clue station (Clues 2-6 since Clue #1 is provided to the group) to collect as much relevant information as they can. They must spend the first 5 minutes of this time recording information without talking. 2. After 3 minutes have elapsed (or it is clear that everyone is done) provide 3 minutes for "clue groups" to put their minds together and discuss how they think their clue will be valuable to their group once they return. It's important that all students have recorded the key points because all clues are required to solve the mystery.
25 min	<p>Pulling it Together</p> <ol style="list-style-type: none"> 1. Invite students to return to their original groups. 2. <i>“All clues are required to completely solve this mystery. Work together to make your evidence visible to the rest of your group but be mindful that they have important information to share as well. Once all the evidence is ‘out on the table’, you have the rest of the hour to work together to assemble your clues and make your conclusions”</i> 3. As students are working, some groups of 4 may need a clue that they didn’t get to during the clue time. You can just provide them with that missing page once they have had a chance to share the rest of their information.

10 min	<p>Conclusions</p> <ol style="list-style-type: none"> 1. Once students are confident that they have solved the mystery, have them call you over and present the evidence that has informed their response. 2. There are two sources of evidence that support the same conclusion (impact speed of the vase and timing of the accelerating car) if they only provide one piece of evidence and there is still time remaining, challenge them that they do not yet have enough evidence to support their conclusion and that there are still some clues that they haven't used. 3. Once they have found both pieces of evidence or there is only 5 minutes or so left in the period, give the group a conclusion page and instruct them to capture their ideas in a single conclusion statement. 4. Groups will naturally finish at different times, it is ok to have different levels of detail in the conclusion statements depending on how much time they have left.
0-5 min	<p>The Answer</p> <p>Depending on how students do with the task, you can end the period (or start the next period) by going over the solutions together as a class. If most groups get to the at least one of the solutions, it is usually best just to let the task naturally conclude with their conclusions. A teacher revealing the answer sometimes disrupts the feeling of personal discovery and solving a mystery.</p>

Quiz/Exit Ticket (optional)

Depending on timing, you can provide a formative check for students to provide evidence of individual understanding. This can occur at the end of the class period if there is time or at the beginning of class on the following day.